IN THE CLAIMS:

Please amend the claims as follows:

1. (Currently Amended) A method for determining shallow water flow risk, comprising:

developing a geologic model of shallow water flow risk areas;

performing a stratigraphic analysis on ~~only~~ reflected P-wave seismic data of the geologic model to determine a control location within the ~~only~~ reflected P-wave seismic data;

applying a pre-stack full waveform inversion on the ~~only~~ reflected P-wave seismic data at the control location to provide an elastic earth model of the shallow water flow risk areas based on the geologic model and the stratigraphic analysis, wherein the elastic earth model is determined by matching the reflected P-wave seismic data with synthetic seismic data of the geologic model and the elastic earth model comprises P-wave velocity and S-wave velocity;

computing a ratio between the P-wave velocity and the S-wave velocity; and

identifying multiple shallow water flow risk areas using the relationship of the P-wave velocity to the S-wave velocity ratio with respect to seismic travel time.

2. (Original) The method of claim 1, wherein the seismic data comprises seismic data selected from the list consisting of one-dimensional seismic data, two-dimensional seismic data, and three-dimensional seismic data.

3. (Previously Amended) The method of claim 1, wherein the elastic earth model further comprises attributes selected from the list consisting of density, Poisson's ratio, and Lamé elastic parameters.

4. (Original) The method of claim 1, further comprising processing the seismic data to enhance its stratigraphic resolution.

5. (Original) The method of claim 4, wherein the processing the seismic data comprises sub-sampling the seismic data to less than two millisecond intervals.

6. (Original) The method of claim 4, wherein the processing the seismic data comprises using an algorithm with an amplitude preserving flow.

7. (Original) The method of claim 4, wherein the processing the seismic data comprises using an algorithm selected from the list consisting of a pre-stack time migration, accurate velocity normal-moveout correction, and noise removal algorithms.

8. (Original) The method of claim 1, wherein the control location comprises a plurality of control locations.

9. (Cancelled)

10. (Cancelled)

11. (Cancelled)

12. (Previously Presented) The method of claim 1, wherein performing the stratigraphic analysis comprises identifying the control location by using the geologic model to identify a geologic feature selected from this list consisting of faults, blow-outs, bioherms, chaotic facies, cones, diapers, domes, gas vents, gas mounds, mud volcanoes, popckmarks, scarps, slumps, channels, slope fan deposition, and bottom simulator reflectors.

13. (Previously Presented) The method of claim 1, wherein selecting the control location within the seismic data further comprises evaluating the seismic attributes of the seismic data.

14. (Original) The method of claim 13, wherein evaluating the seismic attributes comprises using amplitude-variation-with-offset attributes, comprising intercept and gradient.

15. (Previously Presented) The method of claim 13, wherein evaluating the seismic attributes comprises evaluating polarity changes in reflection coefficient.

16. (Cancelled)

17. (Previously Presented) The method of claim 1, wherein the pre-stack full waveform inversion comprises applying a genetic algorithm.

18. (Previously Presented) The method of claim 17, wherein the genetic algorithm comprises:

generating a plurality of elastic earth models;

generating pre-stack synthetic seismograms for the elastic earth models;

matching the generated seismograms with the seismic data;

generating a fitness for the elastic earth models;

genetically reproducing the elastic earth models using the fitness for the elastic earth models; and

determining convergence of the reproduced elastic earth models to select the elastic earth model.

19. (Original) The method of claim 18, wherein the plurality of elastic earth models comprises a random population of the elastic earth models.

20. (Previously Presented) The method of claim 1, wherein applying the pre-stack full waveform inversion comprises using an exact wave equation having mode conversions and interbed multiple reflections.

21. (Previously Presented) The method of claim 18, wherein matching the generated seismograms with the seismic data further comprises matching normal moveout of the generated seismograms and the seismic data, and matching reflection amplitudes of the generated seismograms and the seismic data.

22. (Original) The method of claim 18, wherein genetically reproducing the elastic earth models using the fitness for the elastic earth models comprises:

reproducing the elastic earth models in proportion to the elastic earth models fitness;

randomly crossing over the reproduced elastic earth models; and

mutating the reproduced elastic earth models.

23. (Previously Presented) The method of claim 1, further comprising applying a post-stack inversion on the seismic data using the elastic earth model to determine the shallow water flow risk over a 3D volume.

24. (Currently Amended) The method of claim 23 ~~1~~, wherein the post-stack inversion is performed using an AVO intercept and a pseudo shear-wave data volume.

25. (Previously Presented) The method of claim 1, wherein shallow water flow risk is identified when the P-wave velocity compared to the S-wave velocity is between approximately 3.5 and approximately 7.

26. (Currently Amended) A computerized method for determining shallow water flow risk using seismic data comprising:

processing reflected P-wave seismic data to enhance its stratigraphic resolution, wherein the reflected P-wave seismic data are obtained from marine towed streamers;

selecting a control location comprising:

performing a stratigraphic analysis on the reflected P-wave seismic data; and

evaluating the seismic attributes of the reflected P-wave seismic data;

applying a pre-stack full waveform inversion on the reflected P-wave seismic data at the control location to provide an elastic earth model of shallow water flow risk areas, wherein the elastic earth model is determined by matching the reflected P-wave seismic data with synthetic seismic data of the geologic model and the elastic earth model comprises P-wave velocity and S-wave velocity;

applying a post-stack inversion on the reflected P-wave seismic data using the elastic earth model to map a ratio between the P-wave velocity and the S-wave velocity in a three dimensional (3D) volume; and

determining ~~the~~ multiple shallow water flow risk areas using the relationship of the ratio between the P-wave velocity and the S-wave velocity with respect to seismic travel time ~~in the 3D volume~~.

27. (Currently Amended) The method of claim 26, wherein the pre-stack waveform inversion comprises using a genetic algorithm comprising:

generating a plurality of elastic earth models;

generating pre-stack synthetic seismograms for the elastic earth models;

matching the generated seismograms with the seismic data;

generating a fitness for the elastic earth models;

genetically reproducing the elastic earth models using the fitness for the elastic earth models; and

determining convergence of the reproduced elastic earth models to select the elastic earth model.

28. (Cancelled)

29. (Currently Amended) A method for determining a shallow water flow risk area, comprising:

developing a geologic model of the shallow water flow risk area;

performing a stratigraphic analysis on ~~only~~ reflected P-wave seismic data of the geologic model to determine a control location within the ~~only~~ reflected P-wave seismic data;

applying a pre-stack full waveform inversion on the ~~only~~ reflected P-wave seismic data at the control location to provide P-wave velocity (Vp) and Poisson's ratio;

computing for S-wave velocity (Vs) using the P-wave velocity (Vp) and the Poisson's ratio;

computing for a ratio (Vp/Vs) between the P-wave velocity (Vp) and the S-wave velocity (Vs); and

identifying ~~the~~ multiple shallow water flow risk areas using the relationship of the ratio (Vp/Vs) with respect to seismic travel time.

30. (Previously Presented) The method of claim 29, wherein the S-wave velocity (Vs) is computed using

$\upsilon = \frac{1-2\left(\frac{V_S}{V_P}\right)^2}{2\left[1-\left(\frac{V_S}{V_P}\right)^2\right]}$, where υ is the Poisson's ratio, Vp is the P-wave velocity and Vs is the S-wave velocity.

31. (Previously Presented) The method of claim 1, wherein the P-wave seismic data are a single component P-wave seismic data.

32. (Previously Presented) The method of claim 1, wherein the S-wave velocity is obtained indirectly from an amplitude variation with offset (AVO) analysis of the P-wave seismic data.

33. (Previously Presented) The method of claim 1, wherein the stratigraphic analysis excludes S-wave seismic data that would have been acquired in a marine environment.

34. (Previously Presented) The method of claim 1, wherein applying the pre-stack full waveform invention comprises deriving the S-wave velocity.